APPENDIX B

PUMPING STATION FUNCTIONAL DESCRIPTION

Figure 1 60ANF-6515-S-265-094 Section 7_R0-signed

TETRA TECH

AGNICO EAGLE

MELIADINE PROJECT
BLOCK 007 – PERMANENT PUMPING STATIONS
PACKAGE 6515-S-265-094
FUNCTIONNAL DESCRIPTION

March 30th, 2017
Revision 0

Prepared by:

Marc Tremblay, Eng.

Verified by:

George Floarea, P.Eng.

George Floarea, Eng.

Verified by:

Normand Ménard, Eng.

Verified by:

Pierre-Alexandre Bossé, Eng.

Verified by:

Sébastien Perron

Approved by:

Benoit Tremblay, Eng.

Table of contents

1. DOCUMENT OBJECTIVE

This document describe the programming of the control logic to be implement for the control system of the 2 pumping stations, 65PST40001 (CP-1) and 65PST40005 (CP-5) for the Agnico Eagle Meliadine mine Project located at Meliadine Lake in Nunavut.

The 65PST40005 pumping station is located upstream approximatively 1 km from the 65PST40001 which is located upstream of the water treatment plant near Meliadine Lake. Each pumping station will have their own PLC and HMI, the programming include both 65PST40001 and 65PST40005 new PLC and HMI.

2. SYSTEM DESCRIPTION

Each pumping station consist of a sump pit, 2 submersibles pumps, piping, valves, electrical equipment, instrumentation and control equipment's all installed in a heated building. Depending of the pumping capacity requirement, two pumps could be working at the same time, however if only one pump is required, the other will be in standby for back-up. .

2.1 Pumping station 65PST40001 (CP-1)

Surface water from CP-1 pond is brought into the 5.7 m deep sump of 65PST40001 pumping station using two HDPE pipes (400 mm and 500 mm). To pump the water from the sump to the Effluent Water Treatment Plant (EWTP), two 110HP submersible pumps (65PSU40001A and B), with variable speed drives (VFD) are used

An ultrasonic level transmitter 65LIT6950227 measure the sump water level and transfer the signal to the control panel (PLC1) for pump control and indication on the local HMI. A 100 mm drain line with an automatic butterfly valve 65FV6950229 is connected to the discharge line near the pumps to drain the discharge main line back to the sump when the pumps stop. This draining automatic procedure helps draining the portion of pipeline higher than the pumping station and prevent this section to freeze in case of pump failure by example.

Two magnetic flowmeters will be installed on the 400 mm (16") main line going to Meliadine Lake. One flowmeter is located at the EWTP station(65FIT6930001) and the second one downstream of the EWTP, near Meliadine Lake (65FIT6930020). Both flowmeters will be used to check for a possible leak in the line by comparing their readings in real time. , one flowmeter will be supplied loose by the pumping stations manufacturer, the other one by the EWTP manufacturer. Leak detection programing will be done in the EWTP station control system and therefore is not included in this document.

The EWTP is located near CP-1 pond, it treats water incoming from pond CP-1 (and CP-5) before it will pumped to the Meliadine lake. The EWTP package is supplied by others.

2.2 Pumping station 65PST40005 (CP-5)

Surface water from CP-5 pond is brought into the 3.47 m deep sump of 65PST40005 pumping station using two HDPE pipes (400 mm and 500 mm). To pump the water from the sump to the CP-1, two 45HP submersible pumps (65PSU40005A and B), with soft starts are used

An ultrasonic level transmitter (65LIT6950207) measures the sump water level and transfers the signal to the control panel (PLC5) for pump control and indication on the local HMI. A 100 mm drain line with an automatic butterfly valve (65FV6950209) is connected to the discharge line near the pumps to drain the discharge main line back to the sump when the pumps stop. This draining automatic procedure helps draining the portion of pipeline higher than the pumping station and prevent this section to freeze in case of pump failure by example.

Two magnetic flowmeters are installed on the 400 mm main line going to the CP-1. One flowmeter (65FIT6950211) is located close to the pumps' discharge and the second one (65FIT6950213) at the end of the main line, near CP-1 pond. Both flowmeters, which will be used to detect possible leaks in real time by comparing their readings, will be supplied loose by the pumping stations manufacturer. As opposed to the 65PST40001 station, leak detection programing will be done in the PLC-5.

3. 65PST40001 (CP-1) CONTROL

In the first phase of the project, the water volumes in CP-1 require only one pump to be in operation. The second pump will serve mainly as a spare.

Each pump is equipped with a 3 positions selector Manual/Auto/Maintenance at the local HMI, 65HIK6950220 for pump 65PSU40001A, 65HIK6950225 for pump 65PSU40001B, and either a start/stop button for each pump, 65HS6950220 and 65HS695225. The selectors function are as followed:

Manual (left) :	The pump start and stop with the start and stop buttons on the HMI. The pump respect the interlocks (Low low level for example).
Auto (middle) :	The pumps will start and stop automatically according to the PLC command.
Maintenance (middle) :	The pump jog with the start button on the HMI, the pump doesn't respect the interlocks.

3.1 Manual Mode

In this mode the PLC controls the pump via the Start/Stop buttons on the HMI. The pump will respect the interlocks (if the low low level is reached, it won't start back). This mode should be used to keep the pump stopped or for manual operation.

3.2 Maintenance Mode

The pump is not running, it will start when the start button on the HMI is held and automatically stopped when it's release, it does not respect the interlocks.

3.3 Auto Mode

This is the normal operating mode. During normal operation, the selector on the local HMI is set to AUTO position therefore the PLC1 will start and stop the pump and regulating the pump speed according to the process conditions and demand from the EWTP PLC.

The PLC will control the selected pump in this mode, the back-up pump will be in Manual.

1. Pump start-up sequence

Starting interlock:

The following interlock are checked to authorize the pump start.

- No Emergency-Stop
- Pump in Auto mode
- VFD is ready
- No low level in the sump pit
- EWTP starting command flag is on

The pump cannot start only by the CP-1 local interlock, the EWTP system will initiate the starting sequence depend on his demand. When all local conditions are true, the pump is ready to start and wait from the EWTP start command, when this command is initiate, the pump starting sequence begin as follows:

- Starting the pump in auto mode 65PSU40001A or B
- Close drain valve 65FV6950229
- Signal output 65FIC6930001 to VFD set to minimum, (?? %, to come)

Once the pump is started, the following confirmations are check

- The pump is running
- The drain valve 65FV6950229 is close after 30 seconds (actuator travel time is 14 sec)

If these feedback are not confirmed, an alarm shall be initiate at the local HMI and at the EWTP control system. .

2. Pump speed control

When the pump is running and the drain valve is confirm close, the PLC control the pump speed by the speed Modbus Ethernet register in the VFD according to the 65FIC6930001 output that set the pump speed.

Depending on the flow coming from the CP1 pond and the EWTP capacity, the sump pit level will vary and act as a buffer. The speed set point of the pump will be dictated by the EWTP plant PLC, while the CP-1 PLC will transfer the speed require to the VFD by the local Ethernet network. Therefore the control strategy for the pump speed control will be detailed in the EWTP functional description.

3. Pump stop sequence

The pump could be stopped either by the EWTP plant (normal operating mode) or by the local CP-1 PLC if one of the interlock listed in 3.3.1 is disable.

- Emergency-Stop is activated
- Pump not in Auto mode
- VFD is not ready
- Low level in the sump pit

Under certain circumstances, if the water level becomes too low in the sump, the pump shall be stopped to avoid cavitation.

When the water level reaches a low level (?? %, to come) (65LAL6950227), the pump will be stopped with the following sequence.

- The pump is stop.
- The drain valve 65FV6950229 is open and remains open until the pump is start again.
- Motor status feedback and valve position is sent to the PLC.

If these feedbacks are not confirmed, an alarm shall be initiate at the HMI.

The pump in Auto mode will remain stopped until the level rise above the high level set point 65LAH6950227 and the EWTP PLC initiate the start command, then the start sequence will be initiated again. The pump will stop with the low level 65LAL6950227.

4. Emergency stop 65HSS6950220

An Emergency Stop push-bouton, 65HSS690220 located near the pump will stop the pump immediately (no matter what the process conditions or alarms are). This Emergency Stop shall have a protective cover to avoid accidental actuation.

5. Drain Valve 65FV6950229

The drain valve 65FV6950229 is equipped with a 3 positions selector, 65HIK6950229 (Manual/Auto/Maintenance) and a Close/Open buttons on the HMI, 65HS6950229. The normal operating mode is Auto, in this mode the PLC control the valve opening and closing. In manual mode, the valve can be open and close with the HMI in respect with the interlock, while in maintenance mode the valve is close and can be openned by holding the open command on the HMI independently of the interlocks.

3.4 Alarm List

The following alarms shall be programmed in the HMI 65HMI69501.

Alarm tag #	Description	Set point
65LAHH6950227	High High level Alarm sump CP-1	To come
65LAH6950227	High level Alarm sump CP-1 (Start pump)	To come
65LAL6950227	Low level Alarm sump CP-1 (Stop pump)	To come
65LALL6950227	Low Low level Alarm sump CP-1	To come
65XA40001A/1	65VFD40001A motor VFD fault	n/a
65XA40001A/2	65PSU40001A motor GFI Trip	n/a
65HA40001A	65PSU40001A motor start problem	n/a
65XA40001B/1	65VFD40001B motor VFD fault	n/a
65XA40001B/2	65PSU40001B motor GFI Trip	n/a
65HA40001B	65PSU40001B motor start problem	n/a
65ZA6950229	Drain valve malfunction	n/a
65HA6950220	Emergency stop activated	n/a

4. 65PST40005 (CP-5) CONTROL

Depending of the flow coming from the CP-5 pond, one or two pump will be required, therefore the PLC will controlled one or two pump at the same time. If only one pump is required, the second pump will be used as back-up. CP-5 pumps do not have VFD, only soft start, and therefore they are on-off controlled.

Each pump is equipped with a 3 positions selector Manual/Auto/Maintenance at the local HMI, 65HIK6950200 for pump 65PSU40005A, 65HIK6950205 for pump 65PSU40005B, and either a start/stop button for each pump, 65HS6950200 and 65HS695205. The selectors function are as followed:

Manual (left) :	The pump start and stop with the start and stop buttons on the HMI. The pump respect the interlocks (Low low level for example).
Auto (middle) :	The pumps will start and stop automatically according to the PLC command.
Maintenance (right) :	The pump jog with the start button on the HMI, the pump doesn't respect the interlocks.

4.1 Manual Mode

In this mode the PLC controls the pump via the Start/Stop buttons on the HMI. The pump will respect the interlocks (if the low low level is reached, it won't start back). This mode should be used to keep the pump stopped or for manual operation.

4.2 Maintenance Mode

The pump is not running, it will start when the start button on the HMI is held and automatically stopped when it's release, it does not respect the interlocks.

4.3 Auto Mode

This is the normal operating mode. During normal operation the selector is set to AUTO position therefore the PLC5 will start and stop the pump according to the process signal from the level transmitter.

1. Pump start-up sequence

Starting interlock

The following interlock are checked to authorize the pump start.

- No Emergency-Stop
- Pump in Auto mode
- Soft start is ready

When all these conditions are true, the pump is start depending on the water level in the sump pit. When 65LIT6950207 reaches a High level at ?? % (to come), 65LAH6950207, the starting sequence begins as follow:

- Starting the pump in auto mode 65PSU40005A or B
- Close drain valve 65FV6950209

Once the pump is started, the following confirmation are check

- The pump is running.
- The drain valve 65FV6950209 is close after 30 seconds (actuator travel time is 14 sec).

If theses feedback are not confirms, an alarm shall be initiate at the HMI.

2. Pump stop sequence

The pump in Auto will run until the sump pit water level reach is low level alarm 65LAL6950207, than the pump is stopped with the following sequence:

- The pump is stopped.
- The drain valve 65FV6950209 is open and remains open until the pump is start again.
- Motor status feedback and valve position is sent to the PLC.

If theses feedback are not confirms, an alarm shall be initiate at the HMI.

The pump in Auto mode will remain stop until the level 65LIT6950207 rise and reach the high level 65LAH6950207, than the start sequence will be initiated again.

3. Emergency Stop 65HSS6950200

   An Emergency Stop push-bouton 65HSS6950200 located near the pumps will stop the pump immediately no matter what the process conditions or alarm are. This Emergency Stop shall have a protective cover to avoid accidental actuation.

4. Flowmeter readings comparison

   As describe in section 2.2, two magnetic flowmeter 65FIT6950211 and 65FIT6950213 are install on the main water line going from the pumping station 65PST40005 to CP1 pond. The flow signal from both meter are send to the PLC and display on the HMI in engineering units, 65FI6950211 and 65FI6950213.

   The mains goal of the flowmeters is to detect a possible leak in the pipe by comparing the 2 flow in real time and generate an alarm at the HMI if the difference between the two flowmeter readings is more than 10% of the actual flow.

5. Drain Valve 65FV6950209

   The drain valve 65FV6950209 is equipped with a 3 positions selector, 65HIK6950209 (Manual/Auto/Maintenance) and a Close/Open buttons 65HS6950209 on the HMI. The normal operating mode is Auto, in this mode the PLC control the valve opening and closing. In manual mode, the valve can be open and close with the HMI in respect with the interlock, while in maintenance mode the valve is close and can be openned by holding the open command on the HMI independently of the interlocks.

4.4 Alarm List

The following alarms shall be programmed in the 65HMI69505

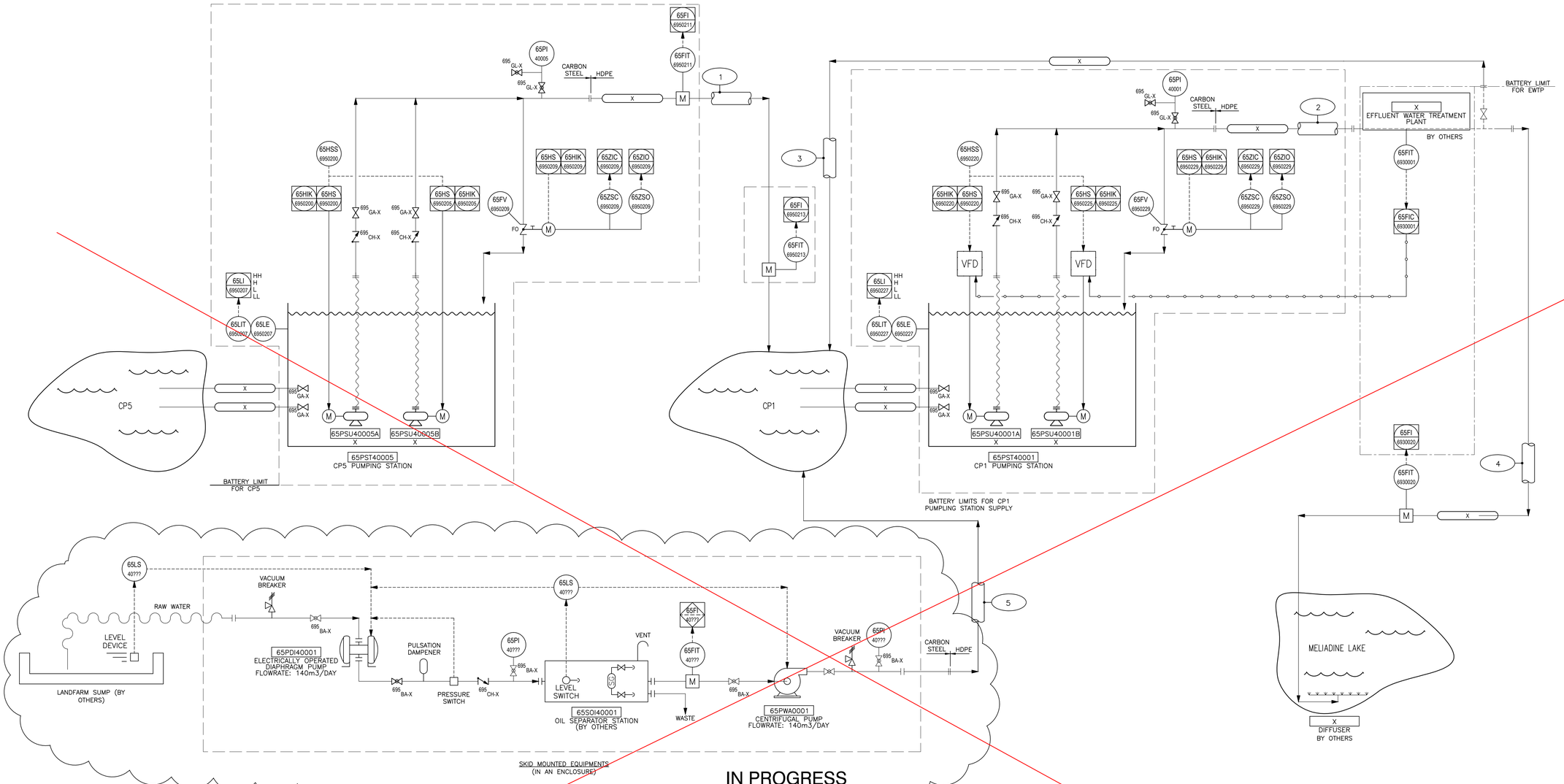
Alarm tag #	Description	Set point
65LAHH6950207	High High level sump CP-5	To come
65LAH6950207	High level Alarm sump CP-5 (Start pump)	To come
65LAL6950207	Low level Alarm sump CP-5 (Stop pump)	To come
65LALL6950207	Low Low level Alarm sump CP-5	To come
65FDAH6950213	High Flow diff 65FI6950213 and 65FI2950211	To come
65XA40005A/1	65PSU40005A motor GFI Trip	n/a
65XA40005A/2	65PSU40005A motor Overload Trip	n/a
65HA40005A	65PSU40005A motor start problem	n/a
65XA40005B/1	65PSU40005B motor GFI Trip	n/a
65XA40005B/2	65PSU40005B motor Overload Trip	n/a
65HA40005B	65PSU40005B motor start problem	n/a
65ZA695209	Drain valve malfunction	n/a
65HSS6950200	Emergency stop activated	n/a

APPENDIX A

P&ID #65-695205-202

NO. DESSIN
DRAWING NO. 65-695-205-202

FORMAT ARCHD



NOTE:

1–FLOWMETERS 65FIT–40005A AND 65FIT–40005B SHOULD BE PROVIDED WITH CP5 PUMPING STATION AND INSTALLED BY OTHERS.

2–FLOWMETER 65FIT–40001A WILL BE PROVIDED AND INSTALLED BY EWTP.

3–FLOWMETER 65FIT–40001B WILL BE SUPPLIED BY OTHERS.

4–FLOWMETER 65FIT–40??? WILL BE SUPPLIED BY OTHERS.

MAXIMUM ESTIMATED FLOWRATE (VALUES INCLUDE A 15% S.F.)						
STREAM NO.		1	2	3	4	5
WATER FLOWRATE	YEARS-3 TO -1 m3/day	19200	14880	X	14500	230
WATER FLOWRATE	MAX THROUGH MINE LIFE m3/day	32775	21840	X	21300	230
HEAT TRACED	YES; NO AND PARTIAL	PARTIAL	NO	NO	PARTIAL	YES

IN PROGRESS

TO REPLACE WITH THE PROVIDED STAMPED DRAWING

NE PAS UTILISER POUR CONSTRUCTION
NOT FOR CONSTRUCTION
AGNICO EAGLE DATE : 2017/03/31

POUR INFORMATION
FOR INFORMATION
AGNICO EAGLE DATE : 2017/03/31

PLAN CLÉ
KEY PLAN

NOTES GÉNÉRALES / GENERAL NOTES

LEGEND:

- SUBMERSIBLE PUMP
- STREAM ID: NUMBER
- LAKE / POND
- CONTACT WATER
- ELECTRICAL SIGNAL
- CHECK VALVE
- GATE VALVE
- BUTTERFLY VALVE
- GLOBE VALVE
- FLANGE
- M ACTUATOR WITH SIDE MOUNTED WHEEL
- AI: ANALOG INPUT
- AO: ANALOG OUTPUT
- DI: DIGITAL INPUT
- DO: DIGITAL INPUT
- INTERLOCK
- INSTRUMENT FIELD MOUNTED
- PLC FUNCTION DATA ACCESSIBLE TO OPERATOR OR ON CONTROL PANEL.
- A1 PLC FUNCTION DATA NOT ACCESSIBLE TO OPERATOR

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–
–	–
–	–
–	–

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
2	2017/03/31	ISSUED FOR INFORMATION	S.G.	M.T.	
1	2017/02/22	ISSUED FOR INFORMATION	S.G.	M.T.	
0	2016/10/14	ISSUED FOR REFERENCE	M.T.	M.R.	

REVISIONS

TETRA TECH

PROJET No.: E14103230 FICHIER No.: 65-695-205-202_1

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
695–WATER MANAGEMENT
P&ID
WATER MANAGEMENT
YEARS –3 TO –1 (2017 TO 2019)

DESSINÉ PAR DRAWN BY	MARIO TREMBLAY	DATE 2016-09-27
VÉRIFIÉ PAR CHECKED BY	MARTIN RICARD	2016-09-27
APPROUVÉ PAR APPROVED BY	MARTIN RICARD, Eng.	2016-09-27
ÉCHELLE SCALE	N/A	DATE 2016-09-27
NO. DESSIN DRAWING NO.	65-695-205-202	
NO. PROJET PROJECT NO.	6515	REVISION 2 / FEUILLE / SHT 1 / 8

AE–CART–ARCH D

\\CAVDO1DAT01\Projet_15X–XXXX–XX\151–06440–10\03–TECH_ORANGE\Dessin\Plant 3D\Process Plant\PID DWG\65–501–205–200.dwg–2016–07–08 10:52:29

FILE NO. 65–695–205–202_1_R2.dwg

APPENDIX C

SCLAIRPIPE TECHNICAL SPECIFICATION

Figure 1 Sclairpipe Technical Specification

MODEL SPECIFICATION
FOR
SCLAIRPIPE® HIGH DENSITY POLYETHYLENE PIPE

1. PIPE & FITTINGS SPECIFICATIONS

1.1 Reference Specifications

ASTM	*D638*	*Standard Test for Tensile Properties of Plastics*
	D792	*Standard Test Methods for Density and Specific Gravity of Plastics by Displacement*
	D1238	*Flow Rates of Thermoplastics by Extrusion Plastomer*
	D1598	*Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure*
	D1599	*Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.*
	D1693	*Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics*
	D2290	*Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe by Split Disk Method*
	D2837	*Standard Test Method for Obtaining Hydrostatic Design Basis for thermoplastic Pipe Materials*
	D3350	*Standard Specification for Polyethylene Plastic Pipe and Fittings Materials*
	F714	*Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter*
	F2164	*Standard Practice for Field Leak Testing of Polyethylene(PE) Pressure Piping Systems Using Hydrostatic Pressure*
	F2620	*Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*
AWWA	*C906*	*Polyethylene Pressure Pipe and Fittings, 4" Through 63" for Water Distribution*
ISO	*9001-2008*	*Quality Systems, Model for Quality Assurance in Production and Installation*

1.2 Material

1.2.1 The resin compound shall be qualified to meet the following:

The pipe shall be made from materials meeting the designations of PE3608 or PE4710 as assigned by the Plastics Pipe Institute.

The pipe shall be made from a polyethylene resin compound with a minimum cell classification of 344464C for PE3608 and 445474C for PE4710 as defined in ASTM D3350.

The Hydrostatic Design Stress (HDS) at 23℃ (73.4℉) shall be 800 psi for resin designated by PE3608 and 1,000 psi for resin designated by PE4710 (PPI TR-4 , Table 1.A.8 for PE3608, Table 1.A.13 for PE4710).

1.2.2 The pipe material shall contain 2% - 2 ½% well dispersed carbon black. Additives which can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe produced meets the requirements of this specification.

1.2.3 The pipe shall contain no recycled compound except that which is generated in the manufacturer's own plant, from resin of the same specification and from the same raw material supplier.

1.2.4 The pipe supplier shall certify compliance with the requirements of this section in writing.

1.3 Pipe Design

1.3.1 The pipe shall be designed in accordance with the relationships of the ISO modified formula as stated in ASTM F714.

1.3.2 The design pressure rating shall be derived using an HDS of 800 psi at 23℃ (73.4℉) for a PE3608 designation and an HDS of 1,000 psi at 23℃ (73.4℉) for a PE 4710 designation, resulting in the following maximum continuous Working Pressure Rating (WPR, psi) for the respective pipe classes:

	DR32.5	DR26	DR21	DR17	DR15.5	DR13.5	DR11	DR9	DR7.3	DR6.3
PE3608	50	64	80	100	110	128	160	200	254	300
PE4710	63	80	100	125	138	160	200	250	317	379

1.3.3 Overpressure limits for pipe shall be allowed a specific magnitude greater than the maximum continuous working pressure of the pipe. Simple guidelines for frequent and infrequent surge conditions are as follows:

i) Frequent surge pressures shall be permitted where the magnitude of the total pressure is not greater than 150% of the maximum allowable continuous working pressure of the pipe. Frequent surge pressures are typically generated by normal pump flow changes and valve operations.

ii) Infrequent surge pressures shall be permitted where the magnitude of the total pressure is not greater than 200% of the maximum allowable continuous working pressure of the pipe. Infrequent surge pressures are described as pump power-out shut down or quick emergency valve closures.

1.4 Fittings

1.4.1 HDPE pipe flange assemblies shall meet the following requirements unless otherwise specified by the engineer:

i) Solid HDPE stub ends or flange adapters shall be made from the same resin grade (PE3608 or PE4710) and shall be formed using extrusion or molding methods.

ii) Flange rings shall be ductile iron (ASTM A536-84) made to Class 150, ANSI B16.1/B16.5 dimensional standards with exceptions.

iii) Methods for flange assembly, gasket selection and bolt torque application shall be as outlined in PPI Technical Note TN-38.

2. QUALITY ASSURANCE

2.1 General Requirements

2.1.1 The general quality assurance practices and methods shall be in accordance with ISO 9001-2008 or equivalent quality management program.

2.1.2 The customer or engineer shall be allowed free access to the manufacturer's plant facilities to audit, witness and inspect the methods, practices, tests and procedures of the quality assurance program.

2.2 Incoming Material Inspection

2.2.1 All incoming materials shall be inspected and tested by the pipe manufacturer for verification of the resin supplier's adherence to the material specification. The test shall include:

i) Density ASTM D792
ii) Melt Flow Rate ASTM D1238
iii) Thermal Stability (DSC) ASTM D3350

2.2.2 In Addition, the resin supplier shall provide certification of the following physical properties with each lot shipment of material:

i) Density ASTM D792
ii) Melt Flow Rate ASTM D1238
iii) Tensile Strength ASTM D638
iv) Elongation ASTM D638
v) E.S.C.R. ASTM D1693 Condition C
vi) Thermal Stability, DSC ASTM D3350

2.3 Finished Goods Evaluation

2.3.1 The following shall be checked or verified on a daily and controlled basis:

i) Pipe dimensions and tolerances as per ASTM F714
ii) Pipe workmanship as per ASTM F714
iii) Pipe attributes of density and melt flow rate
iv) Reverse bend and DSC testing
v) Carbon black content

2.3.2 In addition to the above, pipe physical test requirements shall be verified on a periodic basis with the emphasis of accumulating data to demonstrate conformance for each respective pipe size range to ASTM F714. Test reports shall be submitted for review to the engineer to qualify a manufacturer for conformance purposes. This report shall include as a minimum the following:

Test data dating over one year covering the following production per plant location:

i) Two pipe sizes manufactured in each of the three size ranges: 4" to 12" (100 to 300mm), greater than 12" to 24" (300 to 600mm), and greater than 24" (600mm) shall be tested by elevated temperature sustained pressure test as per Table 3 in ASTM F714, for each polyethylene resin used.

ii) Two pipe sizes manufactured in each of the three size ranges: 4" to 12" (100 to 300mm), greater than 12" to 24" (300 to 600mm), and greater than 24" (600mm) shall be tested for tensile properties. One of the following tests may be used to verify pipe tensile properties:

- Tensile Test as per ASTM D638
- Apparent Tensile Test as per ASTM D2290

2.3.3 Additional tests to be performed to meet the requirements of AWWA C906 shall be as follows (minimum once per year):

i) Apparent ring tensile test as per ASTM D2290
or
Quick burst hydrostatic pressure test as per ASTM D1599

ii) Elevated temperature sustained pressure test as per ASTM D1598 at 80℃
or
Short term 5 second hydrostatic pressure test at four times the working pressure rating

3. MARKING AND SHIPPING

3.1 Marking

3.1.1 The pipe shall be clearly marked using an inkjet printing method such that the marking is visible, legible and permanent.

3.1.2 The marking shall include the following and shall be applied so as to repeat this information at least once in every 5 feet:

i) Name or trademark of manufacturer (i.e. KWH SCLAIRPIPE)

ii) Nominal pipe size (i.e. 14" IPS or 400mm)

iii) Pipe rating (DR 17)

iv) Standard material code designation (i.e. PE3608 or PE4710)

v) Appropriate Manufacturing Standard (i.e. ASTM F714 or AWWA C906)

vi) Production code which describes the resin compound, manufacturing location, year, month and day

Additional markings may be required by the purchaser and shall be added to the markings on the pipe.

3.2 Shipping

Unless otherwise specified by the purchaser, all pipe and fittings shall be prepared for standard commercial shipment. Care shall be taken to prevent cuts, scratches and other damage.

Unless specifically requested by the customer in writing, pipe shipments shall not be nested.

4. CONSTRUCTION PRACTICES

4.1 Inspection of Materials

4.1.1 The customer shall inspect all pipe and accessories for shortages, loss or damage upon receipt of the shipped material at the time of unloading, recording this information directly on the waybill received from the carrier.

4.1.2 Acceptable limits for cuts, gouges or scratches are as follows:

i) Pipe outer surface shall not be cut, scratched or gouged to a depth greater than 10% of the pipe minimum wall thickness.

ii) Pipe internal surface shall be free of all cuts, gouges or scratches.

4.2 Handling and Storage

4.2.1 Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe.

4.2.2 Stacked pipe shall be stored in accordance with manufacturer's recommendations to minimize pipe ovalization.

4.2.3 Pipe shall be handled using suitable slings or lifting equipment. Also, pipe shall not be dragged over sharp objects or surfaces.

4.3 Thermal Butt Fusion

4.3.1 Butt fusion joining of pipe and fittings shall be performed in accordance with the procedures outlined in the manufacturer's 'butt fusion procedures' requirements which are based upon PPI's 'Generic Butt Fusion Procedures' as set out in PPI's TR-33 and as described in ASTM F2620.

4.3.2 Fusion technicians that have been trained in the use of the appropriate procedures (see 4.1.6) and evaluated by fusion equipment manufacturers, must conduct the butt fusion joining.

4.3.3 Butt fusion shall be performed using suitable machinery.

6. TESTING

The intent of leak testing is to find unacceptable faults in a piping system. Leakage tests may be performed if required by the Contract Specifications.

5.1 Pressure Testing Precautions

5.1.1 The pipe system under test and any closures in the test section should be restrained against any unanticipated separation during pressurization. Refer to ASTM F2164. .

5.1.2 Test equipment should be examined before pressure is applied to ensure that it is tightly connected. All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.

5.1.3 Testing may be conducted on the system, or in sections. The limiting test section size is determined by test equipment capability. If the pressurization equipment is too small, it may not be possible to complete the test within allowable testing time limits. If so, higher capacity test equipment or a smaller test section may be necessary.

5.1.4 If possible, test medium and test section water temperatures should not exceed 80° F (27° C). At temperatures above this level, reduced test pressure is required. Before applying test pressure, time may be required for the test medium and test pipe section to temperature equalize.

5.2 Test Procedure

5.2.1 For a test pressure that is 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and the time at the test pressure, must not exceed eight (8) hours[1].

5.2.2 Hydrostatic pressure testing should be done in accordance with ASTM F2164. Clean water is strongly recommended as the test medium. The test section should be completely filled with water, taking care to bleed off any trapped air. Venting at high points may be required to purge air pockets while the test

[1] For test durations longer than 8 hours, the test pressure should be reduced. Refer to PPI Engineering Handbook, Chapter 2 for test methods.

sections are filling. Venting may be provided by loosening flanges or by using equipment vents. Retighten loosened flanges before applying test pressures.

5.2.3 Pressurize the pipe up to the desired test pressure. The test procedure consists of initial expansion, and test phases. For the initial expansion phase, the test section is pressurized to test pressure and make-up test liquid is added as required to maintain maximum test pressure for four (4) hours. For the test phase, the test pressure is reduced by 10 psi. This is the target test pressure. If the pressure remains steady (within 5% of the target test pressure) for an hour, leakage is not indicated.

5.2.4 If leaks are discovered, depressurize the test section before repairing leaks. Correctly made fusion joints do not leak. Leakage at a butt fusion joint may indicate imminent pressurized rupture. Depressurize the test section immediately if butt fusion leakage is discovered. Leaks at fusion joints require the fusion joint to be cut out and redone.

5.2.5 If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.

APPENDIX D

PIPELINE PRE-INSULATED PIPE SPECIFICATION

Figure 1 Urecon Pre-insulated Pipe Specification

URECON

DETAILED SPECIFICATION

PE casing jacket

with standard U.I.P.® system for above grade piping

1. GENERAL

The pipe shall be insulated using the unique two fill U.I.P.® factory insulation process, as supplied by Urecon Ltd., complete with integral conduit(s) for electric heat trace cable (if required). The insulation of associated joints, fittings and accessories shall be as per Urecon's recommendations. The product shall be manufactured in accordance to ISO 9001 Standards, or approved equal.

2. PIPE PREPARATION

Pipe and casing jacket shall be cleaned of surface dust or dirt to ensure adhesion of the foam to the pipe and inner jacket surface.

3. HEAT TRACING CONDUIT(S)

Heat tracing conduit(s) shall consist of an extruded molding and shall be applied to the pipe prior to application of the insulation. The conduit(s) will be securely fastened to the pipe to prevent the ingress of foam therein during the insulation process. All conduit(s) shall be checked after insulating to ensure they are not blocked. The ends shall be sealed prior to shipping to prevent any foreign material from entering the conduit while in transit or during installation.

4. INSULATION

a) Material: Rigid polyurethane foam, factory applied.
b) Thickness: 50.8 mm *(2 in)* or as required.
c) Density: (ASTM D1622) 35 to 48 kg/m³ *(2.2 to 3.0 lbs/ft³).*
d) Closed cell content: (ASTM D6226) 90%, minimum.
e) Water absorption: (ASTM D2842) 4.0% by volume.
f) Thermal conductivity: (ASTM C518) 0.020 to 0.025 W/m℃ *(0.14 to 0.17 Btu • in/ft² • hr • ℉).*
g) Temperature range: Cryogenic to 93.3 ℃ *(200 ℉).*

5. SYSTEM PROPERTIES

a) System compressive strength: (modified ASTM D1621 with casing jacket) approximately 690 to 1379 kPa *(100-200 lbs/in²),* varies with pipe diameter;
b) Service temperature range: the overall factory insulated system limitations are dependent on the core pipe type, insulation and application.
c) Temperature limitations: minimum ambient installation temperature *-34 ℃ (-29 ℉).*

6. PE CASING OUTER JACKET

The outer protective jacket shall consist of black PE, UV inhibited, factory applied with the following specifications:

a) Casing shall be extruded from polyethylene resin with cell class requirements 334360C as defined in ASTM D3350-12;
b) Polyethylene compound shall be of color and UV stabilizer Code C (black) as specified in ASTM D3350, with a target range of 2 to 2.5% well dispersed carbon black (max. 2.8%);
c) Jacket thickness shall be 3.81 mm *(150 mils)* to 7.62 mm *(300 mils)* depending on pipe diameter and PE casing availability from supplier.

URECON PRE-INSULATED PIPE
Coteau-du-Lac, Quebec (450) 455-0961
Calmar, Alberta (780) 985-3636
Florida (321) 638-2364
www.urecon.com

7. INSULATED PIPE JOINTS

a) Butt-fused and welded joints

Insulated pipe joints shall be completed with Slipjoint® kits consisting of preformed polyisocyanurate foam or polyurethane foam half shells supplied with PE cover sheet, stainless steel bands, gear clamps and self tapping screws. All PE overlaps at the joints and fittings shall be 50.8 mm *(2 in)* minimum and shall be field positioned in such a way as to shed water. The insulation shall be pre-grooved on the inside or slightly oversized to accommodate heat trace cable(s) if applicable.

Waterproofing: Where waterproofing is required, a heat shrink sleeve as supplied by Urecon shall be field applied to the insulation half shells as primary seal under the PE cover sheet. For more demanding waterproof application, Urecon Mec-Seal® joint kits should be considered in place of Slipjoint® kits with primary seal.

b) Bell x spigot joints

Insulated pipe joints with no mechanical restraints shall be completed - if the system is not electrically heat traced - with a 152.4 mm (*6 in*) wide PE cover sheet, stainless steel bands and gear clamps or 304.8 mm *(12 in)* to 609.6 mm *(24 in)* wide PE cover sheet if traced, depending on pipe size.

Waterproofing: Where waterproofing is required, a heat shrink sleeve as supplied by Urecon shall be field applied as primary seal under the PE cover sheet. For more demanding waterproof application, Urecon Mec-Seal® joint kits should be considered in place of Slipjoint® kits with primary seal.

8. INSULATION KITS FOR FITTINGS

Insulation kits for fittings shall consist of rigid polyisocyanurate or polyurethane foam half shells complete with a heavy polymer protective coating on the outside surfaces. All insulation kits shall be supplied complete with silicone caulking, stainless steel bands and gear clamps. If the insulation shells are form hugging to the fitting, 152.4 mm *(6 in)* wide PE cover sheets with stainless steel bands and gear clamps shall be supplied for each end of the kit.

a) Rigid polyisocyanurate or polyurethane foam

1. Density: (ASTM D1622) 32 kg/m³ *(2.0 lbs/ft³)*.
2. Compressive strength: (ASTM D1621) 124 to 186 kPa (18 to 27 lbs/in²).
3. Closed cell content: (ASTM D2856) 90%, minimum.
4. Water absorption: (ASTM C272) 2.0% by volume.
5. K factor: (ASTM C518) 0.027 W/m°C (0.19 Btu • in/ft² • hr • °F).
6. Thickness: typically 50.8 mm (2 in), other thicknesses upon request, shall match pipe insulation thickness.

b) Polymer coating, Urecon BL-100-20EP

1. Two component high density polyurethane coating, black in color.
2. Density: 1170 kg/m³ *(73 lbs/ft³).*
3. Durometer D scale 60.
4. Tensile strength: 11.10 MPa *(1610 lbs/in²).*
5. Tear strength: 26.5 N/mm *(151 lbs/in).*
6. Thickness: 2.54 mm *(100 mils)* outside surfaces, 0.51 mm *(20 mils)* inside surfaces.

9. ELECTRIC TRACING SYSTEM

The electric tracing system and associated controls shall be as per the manufacturer's recommendations with particular attention being paid to the watt densities applied through conduits on plastic pipes. All tracing cables and related accessories to be CSA approved and comply with CSA heat tracing standard C22.2 No. 130-03. Standard of acceptance is Urecon's Thermocable or approved equal. Please contact your Urecon representative for further details and design assistance.

Note: *Physical characteristics are nominal and may vary depending on pipe type and diameter.*

CANADA

75 boulevard Dupont
Coteau-du-lac (Québec) J0P 1B0
Tél: (450) 455-0961 Fax: (450) 455-0350
E-mail: sales.east@urecon.com

5010 – 43rd Avenue
Calmar (Alberta) T0C 0V0
Tel: (780) 985-3636 Fax: (780) 985-2466
E-mail: sales.west@urecon.com

WEB SITE: www.urecon.com

I S O 9 0 0 1 Registered Company

UNITED STATES

Tel: (321) 638-2364 Fax: (321) 638-2371
E-mail: sales.usa@urecon.com

WEB SITE: www.urecon.com

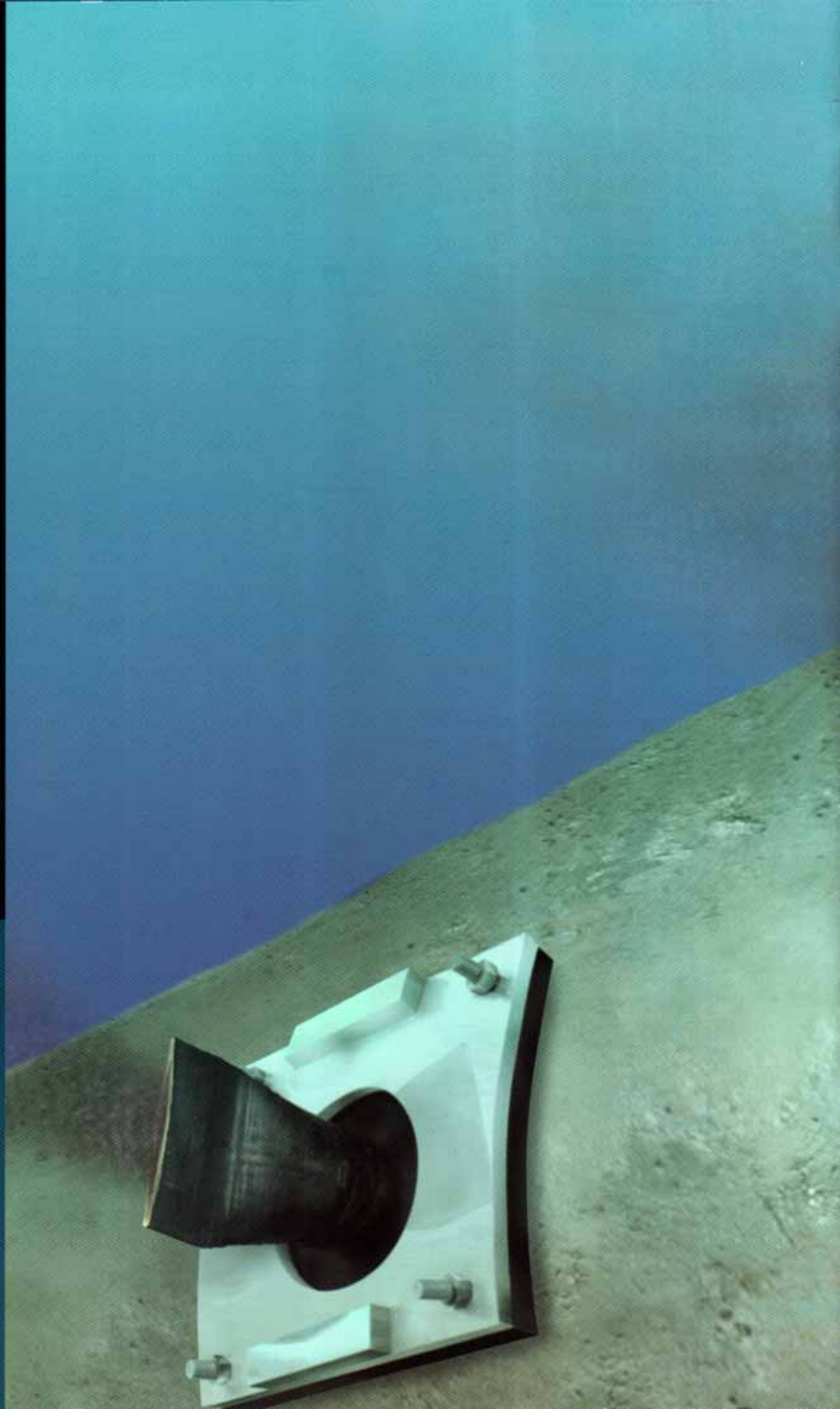
URECON PRE-INSULATED PIPE

Coteau-du-Lac, Quebec (450) 455-0961
Calmar, Alberta (780) 985-3636
Florida (321) 638-2364
www.urecon.com

APPENDIX E

DIFFUSER TIDEFLEX VALVE SPECIFICATION

Figure 1 Brochures of Tideflex Valves



Red Valve Company, Inc.

700 N. Bell Avenue
Carnegie, PA 15106

PHONE:
412/279-0044

FAX:
412/279-7878

www.redvalve.com

RVM 2/98 10M

300mm rubber risers with two 200mm Tideflex diffuser valves. Multiport risers achieve dilution while minimizing the number of risers.

Eighteen 8" series 350 valves with integral 90° elbows for effluent diffuser in Georgia.

RED VALVE
HYDRAULIC DIFFUSER ANALYSIS

Your Partner in Engineering Design and Technical Analysis for Effluent Diffuser Systems.

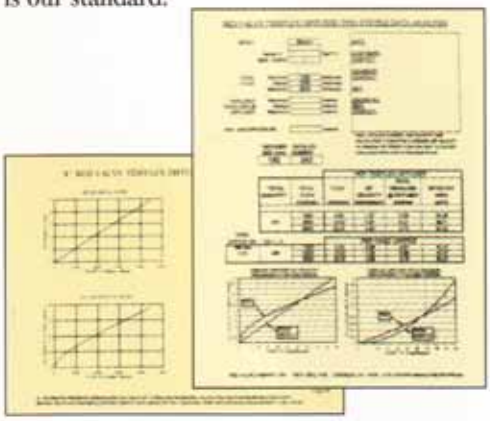
Each diffuser system is unique. Red Valve Company has conducted extensive hydraulic tests on Tideflex diffuser valves from 2" (50 mm) to 48" (1200 mm) and has developed an exclusive computer program to assist engineers in designing multiport diffusers. The program includes data analysis on headloss, total headloss, jet velocity and effective open area. This data can be compared to conventional fixed-orifice diffuser designs to illustrate the hydraulic advantages of Tideflex valves (I).

Also available for individual Tideflex valves are graphs of headloss, total headloss, jet velocity and effective open area organized in a "4-pack" format (II).

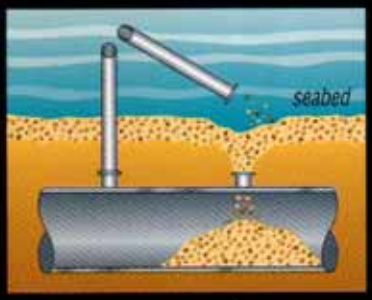
For a diffuser nozzle hydraulics analysis, please contact our engineering department.

35 SQ square flange

Your special diffuser valve design is our standard.



PROBLEM



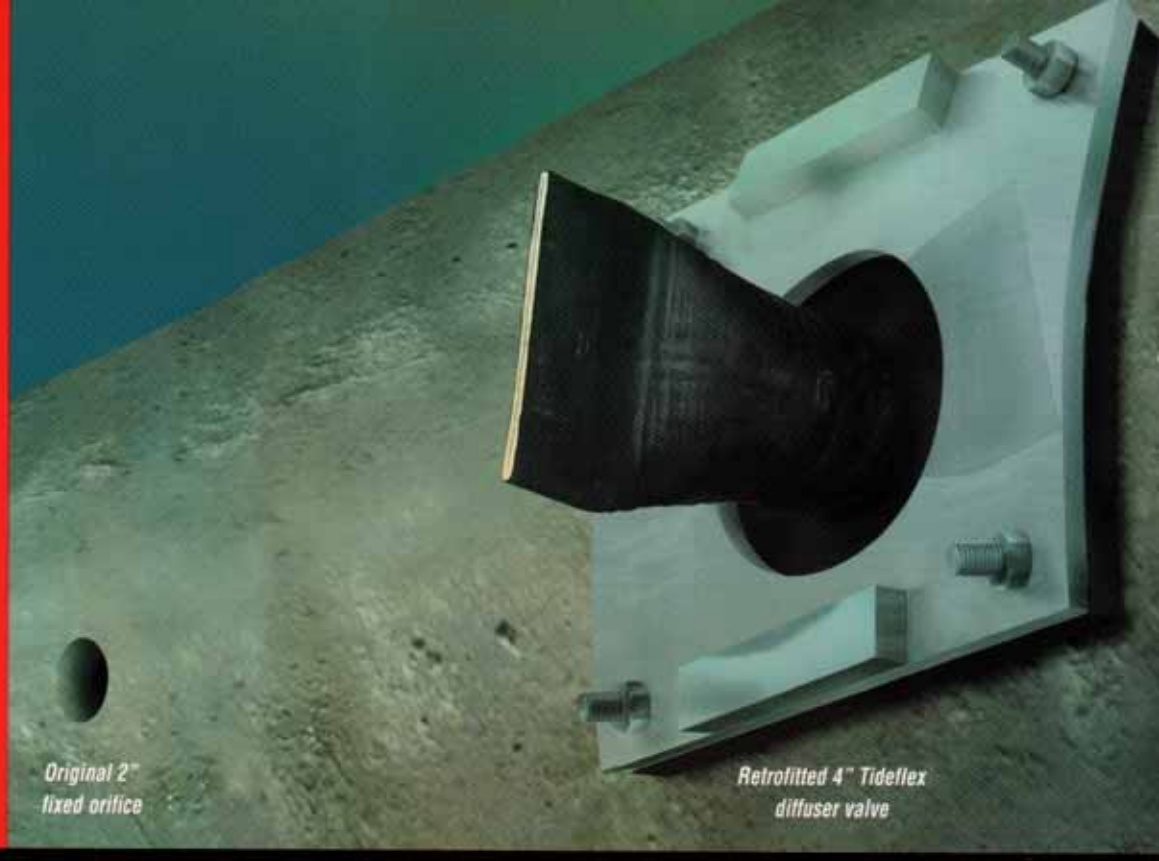
Plastic and metal risers are rigid and are prone to being broken from diffuser pipeline.

SOLUTION

Tideflex check valves with integral rubber risers and elbows are flexible, eliminating damage from boat anchors, nets and debris.

129 four-inch Tideflex valves with 16" square flanges were retrofitted over original 2" fixed-orifice ports on a reinforced concrete outfall in California.

The four-hole, square-flanged 35-SQ Tideflex reduces installation costs and minimizes stress on the outfall pipe.



RETROFITTING EXISTING DIFFUSER PIPELINES

Available with slip-on, circular-flanged and square-flanged fabricated connections, Tideflex diffuser valves can accommodate almost any effluent diffuser system.

The slip-on valves can be clamped to the outside diameter of riser pipes, and circular-flanged valves can be fastened to any flange, including ANSI and DIN drillings. The square-flanged valves can be fastened directly to the outside diameter of an outfall pipe.

Common for outfalls that rest on the riverbed or seabed unburied, the square-flanged valves have a four-hole arrangement, compared to an eight- or twelve-hole pattern, that minimizes localized stress and makes installation easier.

FLEXIBLE RISERS AND ELBOWS

The risers incorporated in buried diffusers are usually metal or plastic and, therefore, prone to being sheared from the outfall by impacting debris, anchors, nets, etc. These breaks allow considerable amounts of riverbed or seabed bottom material to backflow into the outfall.

Tideflex diffuser valves can be integrally fabricated with all-rubber risers and/or elbows. They are flexible, durable and designed to deflect and return when subjected to impact loads such as those from anchors and nets. Having Tideflex diffuser valves fabricated with rubber risers and elbows ensures only flexible components are above the seabed or riverbed, eliminating physical damage to the diffuser.

Tideflex diffuser valves can be retrofitted to any diffuser system operating at a reduced efficiency. They prevent backflow of sediment and salt water and optimize the hydraulics by generating higher jet velocity at low flow and providing a more uniform flow distribution. Tideflex diffuser valves are especially suited for emergency overflow outfalls or decommissioned outfalls since they are susceptible to severe intrusion and marine fouling.


TF-D


35D with 90° elbow


35D with 45° elbow


35D with rubber riser

12 six-inch Tideflex diffuser valves with integral three-foot- long rubber risers discharging to a shallow river.

A 30° orientation from the horizontal discharge angle enhances dilution from this pulp mill diffuser.

INLAND OUTFALLS

Outfalls that discharge to inland waters, such as rivers, streams and lakes, often exhibit problems with intrusion of sediment and debris into the diffuser. Incorporating Tideflex diffuser valves on new diffusers or retrofitting existing diffusers, prevents backflow and ensures the outfall will operate as initially designed.

In addition, the effluent typically is the same density as the receiving water body, meaning there is no buoyancy difference to assist in increasing dilution. The receiving body in inland outfalls often has a limited assimilative capacity and a limited depth. Jet velocity, therefore, is critical, since it alone can optimize initial dilution.

The Tideflex diffuser valve's variable orifice enhances jet velocity throughout the range of flows. This, along with the elliptical plume of the Tideflex diffuser valve, improves overall dilution.

Tideflex diffuser valves assist municipal and industrial dischargers in meeting stringent typical water quality standards established by regulatory agencies. This not only includes bacterial standards for municipal wastewater, but toxic standards for industrial discharges as well. In addition, diffusers with Tideflex diffuser valves have also been installed at textile, pulp and paper, and dye plants specifically to disperse colored effluent to eliminate unsightly "slicks."

44 four-inch Tideflex diffuser valves installed on this award-winning diffuser system for a food processing plant discharging to the Des Moines River.

Twenty 250mm Tideflex diffuser valves on a 1.5 km outfall in Viña Del Mar, Chile.

Eighty 200mm Tideflex diffuser valves installed on multiport riser caps in Hong Kong.

MARINE OUTFALLS

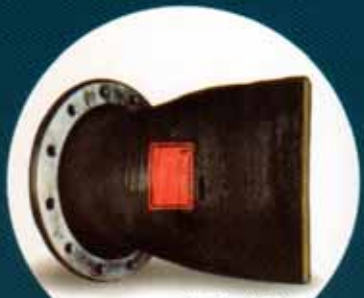
Effluent diffusers that discharge to oceans, estuaries and bays are faced with challenges of strong currents, waves, tides, sediment transport and boat traffic.

These conditions can result in intrusion of sediment and salt water into the outfall, which reduces the hydraulic capacity and dilution efficiency of the diffuser. Since salt water is usually heavier than effluent, it can intrude through the ports even while effluent is discharging.

Once salt water has entered the outfall, it can block numerous ports, imbalance the hydraulics, introduce sediment into the diffuser, promote marine fouling and cause effluent particles to floc and deposit on the bottom of the pipe.

Evacuating sediment from an outfall and rehabilitating the diffuser pipeline typically costs thousands, or even millions, of dollars for large ocean outfalls. Even more of a problem, however, than the expensive repairs is that, with conventional fixed-orifice diffusers, intrusion can recur, requiring continual, costly service.

Tideflex diffuser valves, however, with an all-elastomer "duckbill" design, prevent intrusion of salt water, sediment and debris and keep the outfall operating at peak hydraulic capacity and dilution efficiency. In addition, independent tests in Hong Kong have established that diffusers fitted with Tideflex diffuser valves purge salt water even at extremely low plant flow, allowing all ports to consistently flow. This is beneficial both for the commissioning of a new outfall and for an outfall that has been retrofitted with Tideflex diffuser valves.



Series 35-D

Industrial Discharge

- Pulp & Paper Mills
- Textile Mills
- Chemical Plants
- Dye Plants
- Food Processing Plants
- Power Plants

Tideflex Diffuser Valves:

- Prevent intrusion of debris, sediment, salt-water and aquatic life
- Provide proven long-term, maintenance-free service life
- Enhance jet velocity
- Improve initial dilution
- Provide a more uniform flow distribution across ports

Photo taken from Red Valve's effluent diffuser video, which reviews actual diver inspections of numerous worldwide outfalls.

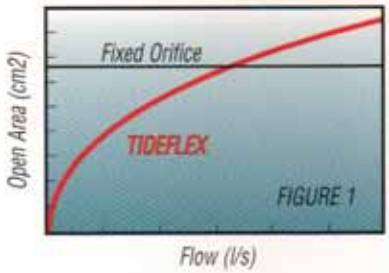
THE TIDEFLEX VARIABLE ORIFICE VS. FIXED-DIAMETER ORIFICE

VARIABLE AREA

In addition to preventing intrusion, back-flow and clogging, Tideflex diffuser valves also enhance the hydraulics of multiport diffusers. Unlike fixed-diameter ports, in which the open area remains constant, Tideflex diffuser valves are inherently variable orifice by design. As Figure 1 illustrates, the open area increases as flow increases, and decreases as flow decreases.

ENHANCED JET VELOCITY

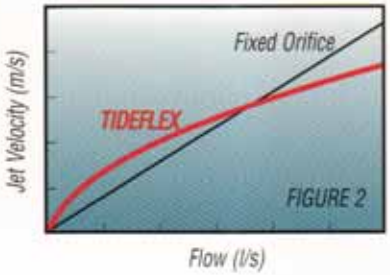
As Figure 2 illustrates, the Tideflex diffuser valve's variable orifice improves jet velocity, or momentum, providing as much as three times the jet velocity of fixed orifices at low flow. This is important because the jet velocity of the flow through each port is a key component for optimizing dilution.



REDUCED HEADLOSS

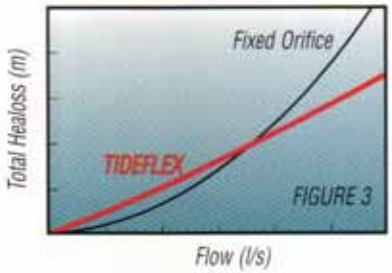
Figure 3 shows the headloss comparison of a fixed-diameter port and the Tideflex diffuser valve. The headloss of a fixed orifice is a function of the flow rate squared. The Tideflex diffuser valve's variable orifice generates less headloss at peak flow, increasing the peak capacity of the outfall, reducing the number of overflows and minimizing energy costs associated with pumps.

Able to meet jet velocity requirements often mandated by environmental agencies, Tideflex diffuser valves still generate an acceptable headloss at peak flow. Sizing fixed-orifice ports to generate a similar jet velocity at low plant flow, on the other hand, typically results in excessive headloss at peak flow.



ELLIPTICAL PLUME

Another advantage the Tideflex diffuser valve offers is its elliptical rather than circular-shaped plume. Independent testing in Oregon and Hong Kong found that this slot-type geometry is proven to provide superior dilution because the receiving water body can disperse the elliptical plume much more quickly than the circular plume. This benefit may be especially desirable for diffusers with stringent water quality standards at the Zone of Initial Dilution (ZID) or other mixing zone boundary.



Red Valve

Your Partner in Engineering, Design and Technical Analysis for Effluent Diffuser Systems

TIDEFLEX® DIFFUSER VALVES

Consulting engineers worldwide specify Red Valve Tideflex diffuser valves for superior performance on effluent diffuser applications.

Effluent outfalls typically incorporate multiport diffusers that discharge effluent over a wide area through numerous ports, rather than through one large open-ended pipe. Providing a cost-effective means of achieving high initial dilution, multiport diffusers minimize the impact of municipal and industrial discharges on the environment.

The most important item on an effluent diffuser system for controlling initial dilution is its port size. A diffuser system's ports ensure that peak flows can be discharged with a limited amount of driving head, ensuring that ports are the correct size and have the proper configuration is critical.

LIMITATIONS OF CONVENTIONAL MULTIPORT DIFFUSERS

The ports of conventional diffusers are holes that were cast or drilled into the outfall pipe, or risers extending from the crown. Referred to as "fixed-orifice" ports, these holes cannot prevent the intrusion of sand, mud, debris and saltwater into the diffuser pipe.

Sediment that enters the diffuser pipe reduces the hydraulic capacity of the outfall, leading to the need for additional pumping operations or causing overflows to bypass outfalls. Additionally, if the ports become blocked—even partially—by accumulating sediment, the diffuser will operate at a reduced dilution efficiency, creating a risk for permit noncompliance and higher bacterial or constituent concentrations on the shore.

TIDEFLEX MULTIPORT DIFFUSERS

Tideflex diffuser valves overcome the challenges associated with conventional multiport diffusers, enabling diffusers to operate at peak performance. Tideflex diffuser valves prevent intrusion of sediment and salt water and optimize diffuser hydraulics and, therefore, eliminate concerns of clogging. In addition, because the valves feature a non-mechanical, all-rubber construction, they will not corrode and remain unaffected by marine growth. Tideflex diffuser valves, virtually maintenance-free, have revolutionized effluent technology for marine and inland outfall lines in municipal and industrial applications.

Red Valve

TIDEFLEX® EFFLUENT DIFFUSER VALVES

APPENDIX F

TETRA TECH GENERAL CONDITIONS

Figure 1 Tetra Tech General Conditions

GENERAL CONDITIONS

DESIGN REPORT

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORT AND OWNERSHIP

This Design Report pertains to a specific site, a specific development, and a specific scope of work. The Design Report may include plans, drawings, profiles and other support documents that collectively constitute the Design Report. The Report and all supporting documents are intended for the sole use of TETRA TECH’s Client. TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses or other contents of the Design Report when it is used or relied upon by any party other than TETRA TECH’s Client, unless authorized in writing by TETRA TECH. Any unauthorized use of the Design Report is at the sole risk of the user.

All reports, plans, and data generated by TETRA TECH during the performance of the work and other documents prepared by TETRA TECH are considered its professional work product and shall remain the copyright property of TETRA TECH.

1.2 ALTERNATIVE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH’s instruments of professional service); only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. TETRA TECH’s instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 ENVIRONMENTAL AND REGULATORY ISSUES

Unless so stipulated in the Design Report, TETRA TECH was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project specific design.

1.4 CALCULATIONS AND DESIGNS

TETRA TECH has undertaken design calculations and has prepared project specific designs in accordance with terms of reference that were previously set out in consultation with, and agreement of, TETRA TECH’s client. These designs have been prepared to a standard that is consistent with industry practice. Notwithstanding, if any error or omission is detected by TETRA TECH’s Client or any party that is authorized to use the Design Report, the error or omission should be immediately drawn to the attention of TETRA TECH.

1.5 GEOTECHNICAL CONDITIONS

A Geotechnical Report is commonly the basis upon which the specific project design has been completed. It is incumbent upon TETRA TECH’s Client, and any other authorized party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the geotechnical information that was reasonably acquired to facilitate completion of the design.

If a Geotechnical Report was prepared for the project by TETRA TECH, it will be included in the Design Report. The Geotechnical Report contains General Conditions that should be read in conjunction with these General Conditions for the Design Report.

1.6 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.